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Trey Hanbury

October 3, 2005

BY ELECTRONIC FILING

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
The Portals
445 Twelfth Street, S.W.
Washington, D.C. 20554

Re: IB Docket No. 02-364
Ex Parte Presentation

Dear Ms. Dortch:

On behalf of Sprint Nextel Corporation (Sprint), Mariam Sorond and I met Friday, September 30, 2005 with Ahmed Lahjouji and Ronald Chase to explain how Sprint arrived at a common set of units to measure interference potential and to demonstrate the large separation distances required between next-generation broadband communications equipment and microwave ovens (MWOs) that operate with unlimited power in the 2496-2500 MHz band.

As explained in the attached analysis, the separation distances necessary to prevent MWOs from causing harmful interference into BRS Channel 1 customer premises equipment (CPE) are much larger than the foreign and domestic MWO manufacturers have suggested. Even allowing for 10 to 20 dB for various forms of signal attenuation, such as building loss, head loss, antenna diversity, and other factors, MWOs and BRS-1 equipment will require separation distances of between 48 meters and 151 meters to avoid an unacceptable degradation in performance that, depending upon the level of the interference and the distance separation from the ISM device, could disable the communications link entirely. Because these large distances far exceed the normal size of a consumer's home, continuing to permit unlimited emissions from MWOs will render "self help" measures by individual BRS consumers largely ineffective.

To prevent harmful interference to consumers, Sprint asked the Commission to extend the Part 18 requirements that ISM manufacturers are already required to meet above 2500 MHz to four additional megahertz of spectrum in the 2496-2500 MHz band. Applying the Part 18 limits to the four megahertz of spectrum in the 2496-2500 MHz band will allow for the deployment of next-generation broadband to consumers using BRS Channel 1. Under section 1.1206(b) of the Commission's rules, 47 C.F.R. § 1.1206(b), please associate this letter with the above-referenced docket.

Sincerely,

/s/ Trey Hanbury

Trey Hanbury
Director, Sprint Nextel Corporation

CC: Bruce Franca, Geraldine Matisse, Ira Keltz, Jamison Prime, Patrick Forster, Ahmed Lahjouji, Ronald Chase, John Schauble

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Interference from ISM Devices to BRS-1:
Unit Conversion and Required Distance Separation

The table below shows the Part 18 out of band emission restrictions and also the levels at which the current Microwave Ovens (MWOs) are operating based on the 1994 NTIA Report.[1] They are all converted to dBm.

Standard	Specified Limit/ Measurement	@ Distance	Conversion to Common units (all @ distance 3 m)		Conversion to Power Density (all @ distance 3m)	
(units)	*(μV/m)*	*(m)*	*(dBμV/m)*	*μV/m*	*(dBm/m²)*	*(dBm)*
CFR47.18 (P<500 Watts)	25	300	68	2500	-48	-77
CFR47.18 (P>500 Watts)	10	1600	75	5333	-41	-71
NTIA 1994 Report on MWO - Median between 2496-2500			82	12589	-34	-63

Example unit conversion:

The conversion from μV/m at a given distance to dBμV/m is given by:

$$\text{Field strength, dB}\mu\text{V/m @ 3 meters} = 20*\log(25\mu\text{V/m}) = 28\ \text{dB}\mu\text{V/m} \qquad (1)$$

Since spreading is related to the inverse of distance squared, the conversion to a common distance is calculated by:

$$\text{Distance conversion factor} = 10*\log(300\text{m}/3\text{m})^2 = 40\ \text{dB} \qquad (2)$$

Therefore the dBμV/m at 3 meters is given by:

$$28\ \text{dB}\mu\text{V/m} + 40\ \text{dB} = 68\ \text{dB}\mu\text{V/m} \qquad (3)$$

Converting to μV/m

[1] National Telecommunications and Information Administration, *Radio Spectrum Measurements of Individual Microwave Ovens*, Report No. 94-303-1 (Mar. 1994) (NTIA Report), *available at* < http://www.its.bldrdoc.gov/pub/ntia-rpt/94-303-1/report.pdf>.

$$=10^{(68\ dB\mu V/m/20)}= 2500\ \mu V/m \quad (4)$$

Converting to power density:

$$\text{Power Flux}(W/m^2)=(2500\mu V/m/10^6)^2/377= -78dBW/m^2 \text{ or } -48\ dBm/m^2 \quad (5)$$

Where 377 is the free space impedance in ohms.

Further conversion to Power Density can be done by adjusting the flux density value by the effective gain of a one-square meter effective area terminal at the frequency of interest, in this case 2.5 GHz. The gain of an antenna with an area of 1 m^2 at 2.5 GHz is 29.408 dBi, therefore:

$$\text{Power density (dBm)}= -48\ dBm/m^2 - 29.408\ dBi = -77\ dBm \quad (6)$$

The preferred operating environment would limit permissible interference levels to no more than -107 dBm. The following table shows the parameters used for achieving this level as compared to -107 dBm.

Noise Figure (dB)	Receiver Bandwidth (MHz)	Rx Thermal Noise (dBm)	Interference Objective (dBm)
7	6	-99	-105
5	6	-101	-107

The specified Part 18 out of band emission levels and the current NTIA MWO report could be further extrapolated for greater distances and modified to include wall and clutter attenuation so that the collocation of a BRS operation and MWO could be analyzed in a typical home.

The results are given in the table below.

	Emission Levels	Attenuation-Multiple Source	Interference Objective	Interference Reduction Required	Separation Distance Required
	dBm	dB	dBm	dB	m
Current NTIA based MWO Average Levels (2496-2500 MHz)	-63	0	-107	44	478
	-63	6	-107	38	240
	-63	10	-107	34	151
	-63	20	-107	24	48
	-63	25	-107	19	27
Part 18 for P>500 Watts	-71	0	-107	37	203
	-71	6	-107	31	102
	-71	10	-107	27	64
	-71	20	-107	17	20
	-71	25	-107	12	11
Part 18 for P<500 Watts	-77	0	-107	30	95
	-77	6	-107	24	48
	-77	10	-107	20	30
	-77	20	-107	10	9
	-77	25	-107	5	5

As shown in the table above, a simple conversion of well-established test data shows that current NTIA MWO average levels in the 2496-2500 MHz band would require from 27 meters to 478 meters of separation distances between the MWO and BRS-1 equipment, depending upon the level of wall clutter and attenuation used for purposes of the analysis. Assuming most buildings use a wall clutter value of approximately 10-20 dB, the separation distance required would range from 48 to 151 meters.

A permissible interference level of -105 dBm would represent a challenging operating environment for radiofrequency devices in the 2.5 GHz band. In the interest of presenting the Commission with a full range of values, separation distances for a permissible interference level of –105 dBm are shown in the following table.

	Emission Levels	Attenuation-Multiple Source	Interference Objective	Interference Reduction Required	Separation Distance Required
	dBm	dB	dBm	dB	m
Current NTIA based MWO Average Levels (2496-2500 MHz)	-63	0	-105	42	380
	-63	6	-105	36	190
	-63	10	-105	32	120
	-63	20	-105	22	38
	-63	25	-105	17	21
Part 18 for P>500 Watts	-71	0	-105	35	161
	-71	6	-105	29	81
	-71	10	-105	25	51
	-71	20	-105	15	16
	-71	25	-105	10	9
Part 18 for P<500 Watts	-77	0	-105	28	75
	-77	6	-105	22	38
	-77	10	-105	18	24
	-77	20	-105	8	8
	-77	25	-105	3	4

Assuming permissible interference of –105 dBm, an attenuation value of approximately 10-20 dB would require separation distances ranging from 38 to 120 meters.

The distance separation data rests on a reverse calculation. Once the interference reduction was calculated, a reverse calculation based on formula (2) is used for calculating the distance necessary to achieve this interference reduction relative to the 3 meters to which all units were converted.

For example for an interference reduction of 42 dB under conditions of zero dB wall clutter and attenuation:

Separation distance required = 10^(42 dB/20)*3 meters = 380 meters